MINERALS SEPARATION, LIMITED, ET AL. *v.* HYDE.

CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

No. 46. Argued October 27, 30, 31, 1916; additional argument November 1, 1916.—Decided December 11, 1916.

Patent No. 835120, issued November 6, 1906, to Henry Livingstone Sulman *et al.*, for improvements in the concentration of ores by a process of oil flotation, is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12, but invalid as to claims Nos. 9, 10 and 11.

The process covered by the patent, as sustained, is simpler and more economical and has proved more successful than the flotation processes relied on as anticipations; it accomplishes separation of metallic particles from ore pulp, not through the buoyancy of oil alone, but largely also through the buoyancy of air bubbles introduced into the mixture of ore, water and oil by means of an agitation differing in kind and degree from that previously employed; and it results

in a froth concentrate of peculiar constitution and stability. For these reasons it is held to be a patentable invention.

It is persuasive evidence of invention that the process in suit came immediately into general use, and has largely replaced all earlier like processes without the aid of puffing or business exploitation.

The patentees planned the experiments, directed the investigations day by day, conducted them largely in person and interpreted the results, and they cannot be denied the status of original discoverers on the ground that their employee made the analyses and observations which resulted immediately in the discovery. *Agawam Company* v. *Jordan*, 7 Wall. 583–603.

A patent for a process of ore concentration which, because of the varied character of the subject-matter, necessarily requires preliminary tests by the user to apply it most successfully to the ores treated, is not on that account invalid, if the process is described in the claims with sufficient definiteness to guide those skilled in the art to a successful use of it.

The particularity and certainty of disclosure which the law requires in patents is not greater than is reasonable, having regard to their subject-matter.

Any variation from the process disclosed in a patent must come within the claims of the patent to constitute an infringement.

214 Fed. Rep. 100, reversed.

THE case is stated in the opinion. For the opinion of the District Court see 207 Fed. Rep. 956.

Mr. Henry D. Williams and *Mr. Wm. Houston Kenyon*, with whom *Mr. F. D. McKenney*, *Mr. Lindley M. Garrison*, *Mr. John H. Miller* and *Mr. Odell W. McConnell* were on the briefs, for petitioners.

Mr. Walter A. Scott, with whom *Mr. Thomas F. Sheridan*, *Mr. George L. Wilkinson*, *Mr. K. R. Babbitt*, *Mr. J. Bruce Kremer* and *Mr. John F. Neary* were on the briefs, for respondent.

MR. JUSTICE CLARKE delivered the opinion of the court.

In this suit the complainants, the first named as the owner and the other as general licensee, claim an infringe-

ment of United States letters patent No. 835120, issued on the sixth day of November, 1906, to Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot. The usual injunction, accounting and damages are prayed for. The District Court sustained the patent as to claims numbered 1, 2, 3, 5, 6, 7, 9, 10, 11 and 12; found that the defendant had infringed each of these claims, and granted the prayer of the petition. The Circuit Court of Appeals for the Ninth Circuit reversed the decree of the District Court and remanded the case with instructions to dismiss the bill. The case is here on writ of certiorari to review that decision.

As stated in the specification, the claimed discovery of the patent in the suit relates "to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue."

The answer denies all of the allegations of the bill and avers that in twenty-five designated United States and five British patents the process described in suit was "fully and clearly described or claimed," and it also avers that the claimed discovery was invented, known and used by many persons long prior to the time when the application was made for the patent in suit. Notwithstanding this elaboration of denial counsel for the defendant in the summarized conclusion to their brief rely upon only five of the many patents referred to as showing that the patent in suit was anticipated and is therefore invalid for want of novelty and invention, viz: Everson (1886), Froment (Italy, 1902; Great Britain, 1903), Glogner (1903), Schwarz (applied for April 19, 1905, issued December 19, 1905), and Kirby (applied for December 17, 1903, issued December 18, 1906). And the defendant, a man obviously experienced in the subject, says that, in his opinion, the

whole basis of flotation concentration was disclosed in the Everson United States patent No. 348157 and in the Froment British patent.

It is clear that in the prior art, as it is developed in this record, it was well known that oil and oily substances had a selective affinity or attraction for, and would unite mechanically with, the minute particles of metal and metallic compounds found in crushed or powdered ores, but would not so unite with the quartz, or rocky non-metallic material, called "gangue." Haynes British patent (1860), and United States patents, Everson (1886), Robson (1897) and Elmore (1901). It was also well known this selective property of oils and oily substances was increased when applied to some ores by the addition of a small amount of acid to the ore and water used in process of concentration. United States patents, Everson (1886), Elmore (1901), and Cattermole (1904).

Prior to the date of the patent in suit a number of patents had been granted in this and other countries for processes aiming to make practical use of this property of oil and of oil mixed with acid in the treatment of ores, all of which, speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass—"the pulp"—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue. From the resulting concentrate the metals were recovered in various ways.

The processes, of this general character, described in the prior patents may be roughly divided into two classes. The process in the patents of the first class is called in the record the "Surface Flotation Process" and it depends for its usefulness on the oil used being sufficient to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and by its buoyancy

to carry them to the surface of the mixture of ore, water and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrate thus obtained into any desired receptacle. The waste material, or gangue, not being affected by the oil and being heavier than water sinks to the bottom of the containing vessel and may be disposed of as desired.

The process of the other class, called in the record the "Metal Sinking Process," reverses the action of the Surface Flotation Process and is illustrated by the Cattermole U. S. patent, No. 777273, in which oil is used to the extent of 4% to 6% to 10% of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water.

The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is "critical," and minute as compared with the amount used in prior processes "amounting to a fraction of one per cent. on the ore," and in so impregnating with air the mass of ore and water used, by agitation—"by beating the air into the mass"—as to cause to rise to the surface of the mass, or pulp, a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment. This froth can be removed and the metal recovered by processes with which the patent is not concerned.

It is obvious that the process of the patent in suit, as we have described it, is not of the Metal Sinking class, and while it may, in terms, be described as a Surface

Flotation Process, yet it differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery.

The prior processes which we have described required the use of so much oil that they were too expensive to be used on lean ores, to which they were intended to have their chief application, and the efforts of investigators for several years prior to the discovery of the process in suit had been directed to the search for a means or method of reducing the amount of oil used, and it is clear from the record that approach was being made, slowly, but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905. The Froment Great Britain patent (1903) and the Kirby United States patent (applied for in 1903 and granted in 1906) are especially suggestive of the advance which was being made toward the desired result, but the Froment process was little more than a laboratory experiment and has never proved of value in practice, and the Kirby process, though approaching in some respects more nearly to the end attained by the process of the patent in suit, found its preferred application in the use of an amount of oil solution equal to one-fourth to three-fourths in weight of the ore treated, which was prohibitive in cost.

Into this field of investigation at this stage of its development came the patentees of the patent in suit. They were experienced metallurgists of London, of inventive genius and with financial resources, and they entered upon an investigation of the processes of oil concentration of ores which was continued through several years, and consisted of a very extended series of experiments in which the quantities of oil, of water and of acid used and the extent and character of the agitation of the mass under treatment resorted to, were varied to an almost un-

paralleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effect on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole "Metal Sinking Process" as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. "on the ore." It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of "float froth," which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less "on the ore" of oleic acid was used. This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface. The extent of the agitation of the mass had been increased as the experiments proceeded until the "series of Gabbett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,100 revolutions per minute."

A careful consideration of the record in this case convinces us that the facts with respect to the process of the patent in suit are not overstated by the plaintiffs' witness, Adolf Liebmann, an expert of learning and experience, when he says in substance:

"The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before. The minerals are obtained in a froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals embedded in such manner that they form a complete surface all over the bubbles. A remarkable fact with regard to this froth is that, although the very light and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for twenty-four hours without any change having taken place. The simplicity of the operation, as compared with the prior attempts, is startling. All that has to be done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from two and one-half to ten minutes and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore."

It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and

different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical. It results without more discussion, that we fully agree with the decision of the House of Lords, arrived at upon a different record and with different witnesses, but when dealing with the equivalent of the patent in suit, in *Minerals Separation, Limited,* v. *British Ore Concentration Syndicate, Limited,* 27 R. P. C. 33. In this decision Lord Shaw, speaking for the court and distinguishing the process there in suit especially from the Elmore oil flotation process which had gone before but which was typical of the then prior art, said: "They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk, they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming round single particles of the metal, floats them to the surface of the liquid."

And Lord Atkinson said: "In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water."

The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining countries of the world, notably in the United States, Australia, Sweden, Chile and Cuba, and that, because of its economy and simplicity, it has largely replaced all earlier processes. This, of itself, is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect. *Diamond Rubber Co.* v. *Consolidated Tire Co.*, 220 U. S. 428; *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S. 403, 429, 430; *The Barbed Wire Patent*, 143 U. S. 275; *Smith* v. *Goodyear Dental Vulcanite Co.*, 93 U. S. 486.

The claim that the patentees of the patent in suit are not the original discoverers of the process patented because an employee of theirs happened to make the analyses and observations which resulted immediately in the discovery, cannot be allowed. The record shows very clearly that the patentees planned the experiments in progress when the discovery was made; that they directed the investigations day by day, conducting them in large part personally and that they interpreted the results. *Agawam Company* v. *Jordan*, 7 Wall. 583–603, rules this claim against the defendant.

Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject-matter.

The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law. *Mowry* v. *Whitney*, 14 Wall. 620; *Ives* v. *Hamilton*, 92 U. S. 426, and *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S. 403, 436, 437.

The evidence of infringement is clear.

While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, "turned failure into success," (*The Barbed Wire Patent*, 143 U. S. 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as "critical proportions" "amounting to a fraction of one per cent. on the ore," and therefore the decree of this court will be that the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11. Claims Nos. 4, 8 and 13 were not considered in the decrees of the two lower courts and are not in issue in this proceeding.

The decision of the Circuit Court of Appeals will be reversed, and the decision of the District Court, modified to conform to the conclusions expressed in this opinion, will be affirmed.